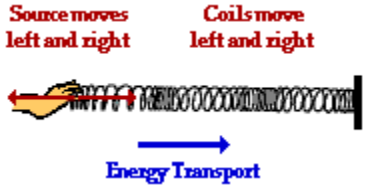
Activity #2



Title: An Investigation into Longitudinal (Compressional) Waves –Student's Copy

Note to students: All answers and diagrams are to be made on a separate answer sheet. Make no marks on this paper.

The terms *longitudinal* and *compressional* are used interchangeably to refer to the type of wave under investigation in this activity.

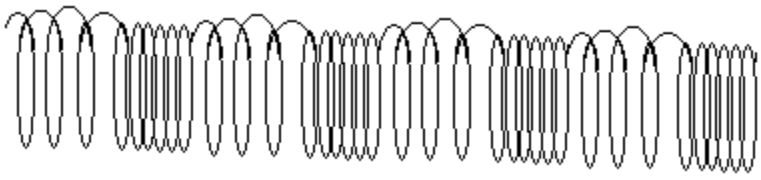
Purpose:

- To create longitudinal waves in a "Slinky^{tm}" –type spring
- To become familiar with the nomenclature associated with longitudinal waves
- To visualize the processes by which waves carry energy from one point to another

Materials: Large diameter spring, meter stick, string (5 cm)

Procedure:

1. Place the Slinky^{tm} spring on your lab counter top and have your partner hold one end while you stretch the spring SLIGHTLY (so there is a spacing of about 1 cm between each of the coils) from the other end. Now snap your hand TOWARDS the other end of the spring about 20 cm and then stop. Describe what you see traveling down the spring.
2. Now snap your hand AWAY from the opposite end of the spring about 20 cm and then stop. Describe what you see traveling down the spring.
3. Now combine the movements described in steps 1 & 2 above and repeat continuously about two times per second. You are producing **longitudinal** or **compressional waves**. Make a sketch of the spring's appearance while producing these waves. Using your textbook or visiting the website:
   http://members.aol.com/nicholashl/waves/movingwaves.html ,
   label the regions where the coils are spaced closer than normal and the regions where the coils are spaced further apart with the appropriate name. You can use a diagram similar to the one below.



4. While producing TWO waves per second (as in step #3 above), measure and record one wavelength in centimeters (which is the distance from one compression to another, or from one rarefaction to another).
5. While producing FOUR waves per second (as in step #3 above), measure and record (in centimeters) one wavelength.
6. From your observations in #4 & 5 above, complete the following statement: As the frequency of a compressional (longitudinal) wave increases, the wavelength _____. (increases, decreases, remains about the same)

7a. Tie a small string to one coil of the large spring and describe its motion as waves travel down the spring. Does the string move parallel (in the same direction) to the wave motion or does it move perpendicularly (at 90^{o}) to the wave motion?

7b. Do the actual coils of the spring move from end to the other as the waves are propagated?

7c. Would molecules of air carrying a longitudinal sound wave actually be traveling at the speed of sound from the sound source to the observer?

8. Describe any similarities of how a transverse wave (from Activity #1) and a longitudinal wave get produced.

9. Describe at least one difference between a transverse and a longitudinal wave.

TECHNOLOGY INTEGRATION: The websites below offer entertaining enrichment activities to enhance the comprehension of the concepts covered in this laboratory activity:

- http://surendranath.tripod.com/Lwave/Lwave01.html allows the user to vary the frequency and amplitude of a longitudinal wave.
- http://www.physicsclassroom.com/Class/sound/u1111b.html demonstrates sound as a longitudinal wave.
- http://www.physicsclassroom.com/Class/sound/u1112d.html discusses and demonstrates how the human ear receives sound waves.
- http://curry.edschool.virginia.edu/teacherlink/content/science/instructional/longitudinal/ Students will investigate and understand how to use models of longitudinal waves to interpret wave phenomena.